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Suppliers' Information Note
For The Openreach Network

Optical Spectrum Extended Access Filter Connect Lite™

Service & Interface Description

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1. Introduction

This Suppliers' Information Note (SIN) describes the Openreach Optical Spectrum Extended Access Filter Connect (OSEA FC) Lite service and its interfaces. OSEA FC Lite is a Hub & Spoke product within the Openreach Optical Spectrum Services portfolio.

This document should be read in conjunction with the OSEA FC Lite Product Description available on the Openreach portal

https://www.openreach.co.uk/orpg/home/products/opticalservices/opticalservices.do

2. General service outline

OSEA FC Lite is available for Hub & Spoke topologies providing end-to-end wavelength services between multiple sites delivered over Openreach provided fibre infrastructure.

OSEA FC Lite offers 10GE/100GE services across 10/100/200Gbit/s wavelengths.

Amplification from the Ciena 6500 or Advanced Amplifier and Filter Chassis (ELS) will be deployed where necessary on supporting configurations. Intermediate Line Amplifiers (ILA) are not supported.

Network fibre connectivity options include single fibre, dual fibre and DWDM (unamplified and amplified). Dual fibre based bearers can be supplied with or without passive DWDM Filters.

OSEA FC Lite supports Filter Connect where optical filters are used. This allows a Communications Provider (CP) to directly connect to available spare ports on the passive optical filters, where fitted, on the bearer to pass traffic over the same fibre path.

The OSEA FC Lite service has maximum radial distance limits between BT serving exchanges, and maximum fibre route distance limits between OSEA Lite bearer circuit end points.

2.1 NTE vendor

The Network Terminating Equipment (NTE) used for OSEA FC Lite service are from Ciena's Routing and Switching Portfolio (RSP) device range. Ciena RSP devices available are:

- 3928
- 5130
- 5160
- 5164
- 5169

- 5171

Optical filters, amplification components, dispersion compensation modules and associated chassis are from the Ciena 6500 or Advanced Amplifier and Filter Chassis platform.

2.2 OSEA FC Lite structure

The elements of the service are:

Hub NTE: This device is configured to act as either a traffic aggregation point or a traffic multiplexing point.

- **Aggregator**: consolidates individual services from multiple spoke NTE devices and then hand off the individual services via separate ports to the CP network.
- **Multiplexer**: a single NTE of appropriate capacity to consolidate multiple individual services from multiple spoke NTE devices and then hand off the individual services via a consolidated higher bandwidth port to the CP network.

Spoke NTE: This device is located at the remote end of a spoke bearer.

Spoke Bearer: this is the optical line system which, with optional passive optical filters, can support up to 12 wavelengths between the Spoke and Hub NTEs.

Managed wavelength: This is a wavelength operating between the Hub and Spoke NTEs and is specific to the protocol and speed required. A minimum of one OSEA FC Lite managed wavelength is required per spoke.

Expansion units: these provide the capacity for end-point amplification on the OSEA FC Lite bearer.

Auxiliary units (Dispersion Compensation Modules – DCMs): these are used when needed on long lines to counteract the effects of Chromatic Dispersion.

DWDM Active filters with amplification: Depending on the customer requirements and the length of the fibre route, active filters with amplification are available. Pre and booster amplification in a single independent chassis at each end, with filter options of 6, 10 or 48 channels.

End-point amplification: Dependent on the configuration of the service and the length of the fibre route, additional end-point amplification may be required to ensure the OSEA FC Lite system works effectively. Intermediate Line Amplifiers (ILA) are not supported.

DWDM Filter: Passive DWDM Filters can be specified where a customer has multiple wavelengths to support or requires future wavelength growth without traffic impact in the future. These are 4 and 8 channel, 100Ghz spaced filters installed in a Ciena 2150 (1RU or 2RU) filter shelf.

Client interface: Provides the physical connection to the CP equipment.

- 10GE SM / MM
- 100GE SR4 / LR4

2.3 Circuit protection

Two levels of spoke bearer circuit protection are available:

- Standard
- Resilience Option 2

Wavelength switching protection is not available. Resilience Option 1 is not available.

Refer to the OSEA FC Lite product description for further information on bearer resilience options and wavelength protection http://www.openreach.co.uk/orpg/products/oss/oss.do

2.4 Geographical availability

The Openreach OSEA FC Lite service is offered throughout the United Kingdom subject to survey.

3. Managed wavelengths

3.1 Service Definition

All OSEA FC Lite managed wavelength services are uncontended with guaranteed bandwidth end to end. All individual services will be provisioned as a separate VLAN. Client traffic can be tagged or untagged and is transported transparently through the OSEA FC Lite link. S-tags will be removed before handing over to client interfaces except where the client interface is carrying multiple services. In this case, each service will have its own S-Tag for identification.

3.2 Service types

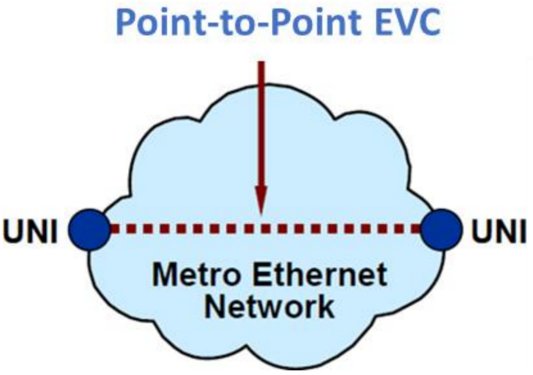
The intention is for OSEA FC Lite services to adopt the MEF E-Line and E-Access service definitions as described below.

E-Line

Ethernet Line (E-Line) is a point-to-point Ethernet Virtual Connection (EVC) used to provide a point-to-point service between two end points. MEF differentiate between following E-Lines:

- EPL - Ethernet Private Line (Port based service offering full transparency)

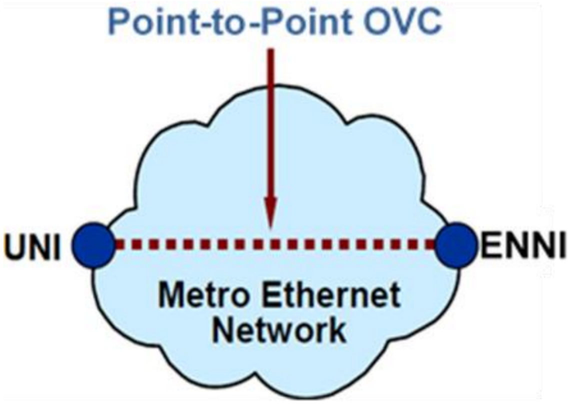
- EVPL – Ethernet Virtual Private Line (CE-VLAN based service offering service multiplexing)



E-Access

Ethernet Access (E-Access) is a point-to-point OVC with only one UNI and one ENNI forming an E-LINE. Therefore, it is used to provide a point-to-point service between one UNI and one ENNI. One ENNI can support multiple E-Access services. MEF differentiate between following Access Ethernet Lines:

- Access EPL – Access Ethernet Private Line (Port based service offering full transparency)
- Access EVPL – Access Ethernet Virtual Private Line (CE-VLAN based service offering service multiplexing)



3.3 VLANs

For an ENNI at the hub that hands over aggregated services to the CP,

- up to 10 individual 10GE flows each with individual VLAN C-Tags inside an aggregated 100GE with an outer configurable VLAN S-Tag conforming to IEEE 802.1q.

Default VLAN IDs are 4001 – 4044. CPs can define their own VLAN IDs in the range 0002 to 4089 at time of ordering. VLAN IDs must be unique within a single hub and spoke architecture but can be reused in different hub and spoke architectures that are separate from each other. CPs must also define the TPID value for the outer VLAN Tag at the time of ordering. The values supported are 0x8100 (C-Tag) or 0x88a8 (S-Tag).

It is the CP's responsibility to ensure that the throughput of any VLAN does not exceed the port speed of the associated spoke NTE (either 10Mbit/s or 100Mbit/s).

3.4 Customer Interface Information

OSEA FC Lite managed wavelengths are available with the following interfaces:

- 10 Gigabit Ethernet (LAN Phy)
- 10 Gigabit Ethernet (WAN Phy)
- 100 Gigabit Ethernet
- 200 Gigabit Ethernet

OSEA FC Lite managed wavelengths are intended for connection to standard optical interfaces of 850 nm multimode or 1310 nm single-mode types. No electrical interfaces are offered. Table 5 gives details of the optical interface/service options. These interfaces are described in the documents listed against each interface in the "References" section.

Service Supported	**Bandwidth (bit/s)**	**850nm (MM)**	**1310nm (SM)**
10G Ethernet (LAN PHY)	10.3125G	Yes	Yes
10G Ethernet (WAN PHY)	9.95328G	Yes	Yes
100G Ethernet	103.125G	Yes	Yes

Table 1: Interface options

3.5 Client optical power margins for both receive and transmit interfaces

Client Service	NTE Device	Client Port Options Pluggable type / maximum speed / wavelength /Single-Mode (SM) or Multimode (MM) / connector type	Rx Min (dBm)	Rx Max (dBm)	Tx Min (dBm)	Tx Max (dBm)
10Gigabit Ethernet	3928	SFP+/10G/1310/SM/LC	-14.4	-0.5	-8.2	0.5
		SFP+/10G/850/MM/LC	-9.9	-0.5	-5	-1
	5130	SFP+/10G/1310/SM/LC	-14.4	-0.5	-8.2	0.5
		SFP+/10G/850/MM/LC	-9.9	-0.5	-5	-1
	5160	SFP+/10G/1310/SM/LC	-14.4	-0.5	-8.2	0.5
		SFP+/10G/850/MM/LC	-9.9	-0.5	-5	-1
	5164	SFP+/10G/1310/SM/LC	-14.4	-0.5	-8.2	0.5
		SFP+/10G/850/MM/LC	-9.9	-0.5	-5	-1
	5169	SFP+/10G/1310/SM/LC	-14.4	-0.5	-8.2	0.5
		SFP+/10G/850/MM/LC	-9.9	-0.5	-5	-1
	5171	SFP+/10G/1310/SM/LC	-17	0	-9	-4
		SFP+/10G/850/MM/LC	-20	-3	-9	-3
100Gigabit Ethernet	5130	QSFP28/100G/1310/SM/LC - LR4 Optic	-10.6	4.5	-4.3	4.5
	5169	QSFP28/100G/1310/SM - LR4 Optic	-10.6	4.5	-4.3	4.5
	5171	QSFP28/100G/1310/SM - LR4 Optic	-10.6	4.5	-4.3	4.5
		QSFP28/100G/850/MM/MPO - SR4 Optic	-9.5	2.4	-7.6	2.4

Table 2: Client Power Parameters

3.6 Maximum reach for managed wavelengths

Wavelength (Gbit/s)	SFW/DFW	Amp. support	NNI	Filter support	Filter size	No amps. (km)	Pre amps. (km)	Pre&Post amp.(km)
10	SFW	NO	10G BiDi (40KM)	NO	-	36	NO	NO
			10G BiDi (80 KM)			57	NO	NO
			10G DWDM	YES	2CH	44	NO	NO
					4CH	40	NO	NO
					6CH	24	NO	NO
			10G DWDM FEC		2CH	68	NO	NO
					4CH	65	NO	NO
					6CH	48	NO	NO
	DFW		10G DWDM	NO	-	57	NO	NO
			10G DWDM FEC			81	NO	NO
		YES	10G DWDM	YES	4CH	44	60	-
					8CH	40	56	-
					12CH	24	50	-
			10G DWDM FEC		4CH	68	90	120
					8CH	65	86	120
					12CH	48	80	108
100	DFW	NO	100G 4WDM-40	NO	-	36	NO	NO
			100G COH.			72	81	120
		YES		YES	4CH	60	76	120
					8CH	56	74	118
					12CH	43	67	114
					ELS	-	-	85
200		NO	200G COH.	NO	-	55	69	90
		YES		YES	4CH	42	62	88
					8CH	39	58	88
					12CH	26	51	88

Table 3: Maximum reach for managed wavelengths using 6500 amplification and filters

Wavelength (Gbit/s)	SFW/DFW	Amp. support	NNI	ELS (Pre&Post amplification)		
				6CH	10CH	48CH
10	DFW	YES	10G DWDM (80 KM)	59	59	59
			10G DWDM FEC	85	85	85
100			100G COH.	85	85	85
200			200G COH.	80	80	80

Table 4: Maximum reach for managed wavelengths using Advanced Amplifier and Filter Chassis (ELS) amplifications with filters

3.7 Frame Forwarding behavior

The OSEA FC Lite NTE is capable of transporting frames conforming to IEEE 802.3 with frame sizes from 64 bytes to a maximum of 2000 bytes. This is to maintain compatibility with a number of frame tagging formats, including VLAN tagging as specified in IEEE 802.1Q. The service is transparent to VLAN tags and will forward VLAN tagged frames in the same way as standard (untagged) frames.

Due to the use of a 4 byte overhead for management purposes, the 10G point to point option is expected to have a reduction of throughput of up to 1% for Customer frame sizes of 400 bytes and above. For customer Ethernet frame sizes smaller than 400 bytes the throughput reduction increases to approximately 6% for 64 byte frames.

The OSEA FC Lite NTE will pass 9192 byte frames, however as this is not yet a recognised Ethernet standard, BT will not validate usage at this level until such time as the IEEE provide an endorsement and published standard for jumbo frames and we have tested against it.

The OSEA FC Lite NTE will not be configured with IEEE 802.d Bridging functionality, which allows for the Learning and Filtering of traffic packets destined for those hosts connected at the local end. Therefore Ethernet frames that would normally be filtered by IEEE 802.1d bridging functionality are instead forwarded across the OSEA FC Lite link.

3.8 Transparency Restrictions

All Ethernet frames are passed across the OSEA FC Lite link, other than the following list of known exceptions:

1. Transport of Ethernet flow control / Pause frames over OSEA FC Lite is not supported.
2. Where Synchronous Ethernet and PTP (Precision Time Protocol) is enabled, IEEE 1588v2 messages (specifically PTP messages transported directly over Ethernet frames) and Synchronous Ethernet ESMC (Ethernet Synchronization Message Channel) packets will be processed, therefore transparent transport of these packet types is not supported. (Note: Synchronous Ethernet and PTP is not currently available on OSEA FC Lite).

4. Filter Connect

Depending on the bearer configuration, OSEA FC Lite supports Filter Connect. This allows CPs to create and manage their own WDM optical services via spare ports on the optical filter.

Openreach will maintain a minimum of one managed wavelength per OSEA FC Lite bearer and then all other filter ports are available for CP use as required. CPs can also choose to have multiple Openreach managed wavelengths on the service.

Openreach retains ownership of the OSEA FC Lite equipment, filters and fibre. Set up and maintenance of CP services, including optical patch cabling, over the own-use Filter Connect ports is the CP's responsibility.

4.1 Filter port allocation guidance

Openreach managed wavelengths will connect from the lowest channel number on the filter working upwards towards the highest channel number. It is recommended that the CP connects their wavelengths from the highest channel number on the filter and works downwards towards the lowest channel number.

4.2 Channel Isolation

The channel isolation specification for all filter types is given below:

Adjacent Channel Isolation (dB)	23
Non-Adjacent DWDM Channel Isolation (dB)	30

Table 5: OSEA FC Lite Filter Isolation

4.3 Optical Safety Limits

The maximum CP Tx output power launched into the optical filter shall be no more than **+6dBm** for any filter configuration. This is to ensure that the solution remains compliant with class 1M from IEC 60825-2 (Safety of Optical Fibre Communications Systems) after the WDM signals are combined by the optical filter. It is the CPs responsibility to ensure that light levels for each optical channel do not exceed this figure.

4.4 10G non-coherent WDM Specifications

10G non-coherent WDM of the following specifications have been used to calculate the maximum optical reach.

- **ITU-T G.698**: These specifications are easy to achieve. For example, they are realisable with most tuneable plugs for 10GE framed WDM.
- **High Performance without FEC:** This is a specification for a higher quality interface without FEC.

- **High Performance with FEC:** Optical reaches of this type are typically delivered using Forward Error Correction and by careful qualification of the same 10G non-coherent WDM at both ends of the link to reduce variety.

If the CP's 10G non-coherent WDM performance meets or exceeds:

- ITU-T G.698: the CP can order the ITU-T G.698 reaches in Table 3
- High Performance without FEC: the CP can order the "No FEC" reaches in Table 3
- The High Performance with FEC reaches in Table 3 give some guidance on what can be achieved and are the maximum reaches Ciena will support for the relevant designs.

4.5 Adjustment for Optical Path Penalty for 10G non-coherent WDM

Note that:

- min. Rx sens. at max. reach = min. Rx sens. at 0km - max. optical path penalty
- min. OSNR at max. reach = min. OSNR at 0km + max. optical path penalty

Some systems vendors quote these specifications at 0km and some quote them at the maximum reach, so some care is required in comparing WDM and determining whether a path penalty needs to be added. An example of a minimum ONSR quoted at maximum reach is shown below.

Minimum Rx OSNR for BER <=1.0 x10-12, -300 to 1500 ps/nm dispersion, Rx input power in the range of -20 to -7 dBm, bit rate in the range of 9.95 to 10.709 Gb/s) = 25.5dB.

4.6 Maximum reach for Point-to-Point applications

The fibre type used to deliver the reaches below is G.652, with maximum fibre loss assumed to be **0.35dB/km**. This includes the loss of any patch panels and fusion splices used by Openreach, fibre ageing and repair margin. The worst case chromatic dispersion for OSEA configurations is **18.3 ps/nm/km**.

Table 3 specifies the maximum reach for 10G non-coherent WDM only. Table 5 specifies the maximum reach for 100G coherent WDM only. Mixed 10G non-coherent and 100G coherent WDM is a supported configuration, but it is not covered by the table below.

Configuration					Filter Type / Reach (km)				
Photonics	**TxRx**	**FEC**	**1x In Line Amp**	**Min Chan.**	**No filter**	**4ch**	**8ch**	**12ch**	**44ch**
Non-amplified	G.698.1-A	no	-	1	-	40	37	23	20
	High perf. (1)				55	42	39	25	22
		yes			76	63	60	46	44
Pre-amplified	G.698.2-B	no	-	1	-	62	59	53	54
	High perf. (1)				-	65	61	55	57
		yes			-	78	76	69	70

				2	-	84	80	75	76
Pre&Post-amp wDCMs	G.698.2-C	no	-	1	-	80	80	80	76
	High perf. (1)				-	95	95	93	84
		yes			-	120	120	120	110

Table 6: Reach table for 10G non-coherent WDM

Configuration			Filter Type / Reach (km)				
Photonics	**1x In Line Amp**	**Min Chan.**	**No filter**	**4ch**	**8ch**	**12ch**	**44ch**
Non-amplified	-	1	54	41	38	24	21
Pre-amplified	-	1	77	67	64	58	58
		2	-	74	69	63	65
Pre&Post-amp	-	1	-	120	120	120	106

Table 7: Reach table for 100G Coherent WDM

The CP is responsible for ensuring that Transmit (Tx) and Receive (Rx) are compatible and are able to meet the specifications quoted on the request form. The CP is also responsible for alien WDM compatibility to achieve the WDM specifications summarized in the reach tables above. This is especially important in the transverse compatibility interoperation case where the WDM combination is less likely to have been tested by systems vendors.

4.7 Commissioning Alien Waves on Filter Connect

Equalisation is required when additional wavelengths are added to amplified Filter Connect systems. This involves inserting the appropriate sizes of pad between:

- Filter Connect and the Tx
- Filter Connect and the Rx.

CPs can perform their own equalization but note that a device capable of measuring per channel power at 100GHz spacing is required. Options include an OSA (Optical Spectrum Analyzer) or Optical Channel Analyser, which is a smaller device measuring per wavelength power but not OSNR.

Equalization is not required for unamplified Filter Connect systems.

The following optical measurements will be shared via the customer handover pack following the certification of an OSEA FC Lite bearer to enable customer network planning over the OSEA FC Lite infrastructure.

- Per site / bearer details to be provided to CP via Customer Handbook:
- Per channel, end-to-end loss for non-amplified bearers
- Per channel, effective gain / loss on amplified bearers
- Total fibre route distance for ITU-T G.652 and details of value of dispersion compensation on link to determine, end to end Chromatic Dispersion.

5. DWDM passive filters and amplifiers

5.1 DWDM passive filters (OMDFx)

OSEA FC Lite optionally uses the OMDF4, four-channel optical filter, or the OMDF8, eight-channel filter. These are 100Ghz spaced filters and used in matched pairs across each bearer. Although not necessary for some basic Spoke configurations, the addition of a filter will allow for multiple wavelengths and future additional managed wavelengths or your own Filter Connect wavelengths.

- **4-channel**
  Half width OMDF4 filter installed in 1U 2150 chassis at each end of link.
- **8-channel**
  Full width OMDF8 filter installed in 1U 2150 chassis at each end of link.
- **12-channel**
  Half width OMDF4 filter plus a full width OMDF8 filter installed in 1U 2150 chassis at each end of link.

5.2 DWDM active filters with amplifiers (Advanced Amplifier and Filter Chassis)

OSEA FC Lite also provides active filters with integrated amplification (Pre and Booster) as optional depending on the customer requirements.

- Advanced Amplifier and Filter Chassis 6CH: Providing 6 channels (Dual Fibre Working) together with Pre and Booster Amplification in one active chassis.
- Advanced Amplifier and Filter Chassis 10CH providing 10 channels (Dual Fibre Working) together with Pre and Booster Amplification in one active chassis.
- Advanced Amplifier and Filter Chassis 48CH providing 48 channels (Dual Fibre Working) together with Pre and Booster Amplification in one active chassis.

5.3 End Point Amplification

For long fibre routes, 6500 Pre and Pre and Booster amplification is available. Amplifiers will be hosted in a 6500 chassis (options: 2, 7, 14 and 32 slot chassis). The 6500 chassis can be shared between circuits on common sites like Hub site for more efficient use of space.

- **Pre-amplification (FGA)**
  Single pre-amplifier in a 6500 shelf at each end of a link to provide greater reach.
- **Pre and Booster Amplification (MLA2)**
  Single pre and booster amplifier in a 6500 shelf at each end of a link to provide the best reach.

Note: DCMs are used for 10G DWDM wavelengths on longer routes to counteract the effects of Chromatic Dispersion

5.4 Channel plan

OMDF/ELS CHANNEL #	ELS Group - Large 48CH	ELS Group - Small 10CH	OMDF8	ELS Group - Small 6CH	OMDF4	WAVELENGTH (nm)	FREQUENCY (THz)
61	**ELS 48CH**	**ALL**		**ALL**		1528.77	196.1
						1529.16	196.05
60						1529.55	196
						1529.94	195.95
59		**A-80**	**A-80**	**A4H**	**A4H**	1530.33	195.9
						1530.72	195.85
58						1531.12	195.8
						1531.51	195.75
57						1531.9	195.7
						1532.29	195.65
56						1532.68	195.6
						1533.07	195.55
55				**A4L**	**A4L**	1533.47	195.5
						1533.86	195.45
54						1534.25	195.4
						1534.64	195.35
53						1535.04	195.3
						1535.43	195.25
52						1535.82	195.2
						1536.22	195.15
51						1536.61	195.1
						1537	195.05
50		**B-80**	**B-80**	**B4H**	**B4H**	1537.4	195
						1537.79	194.95
49						1538.19	194.9
						1538.58	194.85
48						1538.98	194.8
						1539.37	194.75
47						1539.77	194.7
						1540.16	194.65
46				**B4L**	**B4L**	1540.56	194.6
						1540.95	194.55
45						1541.35	194.5
						1541.75	194.45
44						1542.14	194.4
						1542.54	194.35
43						1542.94	194.3
						1543.33	194.25
42						1543.73	194.2
						1544.13	194.15
41		**C-80**	**C-80**	**C4H**	**C4H**	1544.53	194.1
						1544.92	194.05
40						1545.32	194
						1545.72	193.95
39						1546.12	193.9
						1546.52	193.85
38						1546.92	193.8
						1547.32	193.75
37				**C4L**	**C4L**	1547.72	193.7
						1548.11	193.65
36						1548.51	193.6
						1548.91	193.55
35						1549.32	193.5
						1549.72	193.45

OMDF/ELS CHANNEL #	ELS Group - Large 48CH	ELS Group - Small 10CH	OMDF8	ELS Group - Small 6CH	OMDF4	WAVELENGTH (nm)	FREQUENCY (THz)
34						1550.12	193.4
						1550.52	193.35
33						1550.92	193.3
						1551.32	193.25
32		**D-80**	**D-80**	**D4H**	**D4H**	1551.72	193.2
						1552.12	193.15
31						1552.52	193.1
						1552.93	193.05
30						1553.33	193
						1553.73	192.95
29						1554.13	192.9
						1554.54	192.85
28				**D4L**	**D4L**	1554.94	192.8
						1555.34	192.75
27						1555.75	192.7
						1556.15	192.65
26						1556.55	192.6
						1556.96	192.55
25						1557.36	192.5
						1557.77	192.45
24						1558.17	192.4
						1558.58	192.35
23		**E-80**	**E-80**	**E4H**	**E4H**	1558.98	192.3
						1559.39	192.25
22						1559.79	192.2
						1560.2	192.15
21						1560.61	192.1
						1561.01	192.05
20						1561.42	192
						1561.83	191.95
19				**E4L**	**E4L**	1562.23	191.9
						1562.64	191.85
18						1563.05	191.8
						1563.45	191.75
17						1563.86	191.7
						1564.27	191.65
16						1564.68	191.6
						1565.09	191.55
15						1565.5	191.5
						1565.9	191.45
14		**ALL**		**ALL**		1566.31	191.4
						1566.72	191.35

Table 8: ITU Wavelength Grid with OMDF Filters

*Advanced Amplifier and Filter Chassis referred to as ELS in above table

6. OSEA FC Lite service management

6.1 NTE Link Loss Forwarding

OSEA FC Lite will provide Network Link Loss Forwarding by default. User Link Loss Forwarding is optional and can run concurrently with Network Link Loss Forwarding. The CP can request this feature at time of ordering when required.

When a break is detected on the Openreach-side of the network link, all affected customer facing ports will be forced to a link down condition. This continues until such time as the network break is repaired. Such a break may occur at the wavelength level or at the bearer level. In the event of a wavelength level break, only ports on cards transporting traffic on the affected wavelengths will shut down. Note that the E-NNI port (aggregated port) will stay up as the network fault will only affect a single bearer/spoke.

6.2 NTE Auto-Negotiation and Duplex Settings

OSEA FC Lite does not support auto-negotiate to advertise speed and duplex settings. Instead, ports with be set to "auto-neg off" and speed set to speed of interface. Half duplex operation is not supported for any interface type on this service.

7. Connector

7.1 Managed wavelengths

The Network Termination Point (NTP), i.e. the point of connection between the Openreach Network Terminating Equipment (NTE) and the CPE interface for managed wavelengths is the optical client interface on the installed OSEA FC Lite NTE. Optical interfaces are presented as LC connectors, with the exception of 100Gbit/s 850nm (100G SR4), these Optical interfaces are presented with MPO connectors.

7.2 Filter Connect wavelengths

The customer interface and service demarcation point for CP provided wavelengths on OSEA FC Lite Filter Connect is on the optical filter ports. These are dual LC. Either a single duplex or a pair of simplex LC cables may be used where appropriate, though duplex cables with dual LC connectors will ensure that transmit and receive connections are correctly made the right way round.

8. Fibre

Where a service employing a local or remote single-mode interface is provided, all fibre optic connections to and from the patch panel use single-mode fibre 9/125 micron according to ITU-T G.652.

Where a service employing a multimode interface is provided all fibre optic connections to and from the patch panel use multimode fibre 62.5/125 micron or 50/125 micron @ 850nm according to ITU-T G.651.

9. NTE specifics

OSEA FC Lite is suitable for installation in locations that meet the environmental, power and safety requirements of the OSEA FC Lite NTE and supporting equipment.

NTE type	**Operating Temperature**	**Relative Humidity**	**Dimensions**	**Weight**
3928 (AC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	5.0 kg
3928 (DC)	-0°C to +50°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	5.0 kg
5130 (AC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	6.2 kg
5130 (DC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	6.0 kg
5160 (AC/DC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	5.3 kg
5164 (AC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	6.2 kg
5164 (DC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 252mm (D) x 44mm (H)	6.0 kg
5169 (AC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 253mm (D) x 44mm (H)	5.2 kg
5169 (DC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 253mm (D) x 44mm (H)	5.2 kg
5171 (AC/DC)	-20°C to +65°C	5% to 90% (non-condensing)	444mm (W) x 254mm (D) x 88mm (H)	15.5 kg

Table 4: Environmental

OSEA FC Lite NTEs may use either ETSI or 19″ rack mounting practice. Where there is a choice, it is the responsibility of the CP to inform Openreach of the mounting practice to be used

The rack should be grounded with a clean earth supply.

On request from CP, Openreach can provide suitable cabinet(s) at an additional charge. The BT cabinet is 600mm x 600mm footprint with a height of 2.2 metres.

There are four NTE types available in either AC or DC power, these are detailed in the table below. For all chassis types and power options Openreach requires the following additional power supplies:

A 240V AC supply using a 13A switched socket to power the remote network management system. The socket must be within 1.5m of that equipment.

A 240V AC power supply to power Openreach test equipment during both initial commissioning and subsequent maintenance support activities. This socket must be within 1.5m of the NTE.

Further information on installation and power requirements is available from the OSEA FC Lite product description.

NTE type	NTE height*	AC power	DC power
3928	1U	Yes. Dual. Built-in	Yes. Dual. Built-in
5160	1U	Yes. Dual. Hot-	Yes. Dual. Hot-

		swap	swap
5164	1U	Yes. Dual. Built-in	Yes. Dual. Built-in
5171	2U	Yes. Dual. Hot-swap	Yes. Dual. Hot-swap

Table 5: NTE options

* Excludes filters, signal correction equipment, fibre trays.

Further information on specific power requirements can be found in the Openreach AC/DC planning guide which can be found here: www.openreach.co.uk

10. Further Information

For enquiries concerning connection availability between particular sites and for further product information about this service please visit the website at www.openreach.co.uk or contact your Openreach Sales & Relationship Manager or sales specialist.

If you have enquiries relating to this document then please contact: orsinsfa@openreach.co.uk

11. References

ITU-T G.651	Recommendation G.651 (02/98) - Characteristics of a 50/125 µm multimode graded index optical fibre cable
ITU-T G.652	Recommendation G.652 (04/97) - Characteristics of a single-mode optical fibre cable
Fast Ethernet	IEEE 802.3
Gigabit Ethernet	IEE 802.3z or SIN 360 Gigabit Ethernet for the BT Network
IEC 61754-7	Standard for "Fibre Optic Interconnecting Devices & Passive Components – Fibre Optic Connector Interfaces – Part 7: Type MPO Connector Family"
ETSI	European Telecommunications Standards Institute
ITU-T G.8261	Recommendation ITU-T G.8261/Y.1361 - Timing and synchronization aspects in packet networks networks
ITU-T G.8262	Recommendation ITU-T G.8262/Y.1362 - Timing characteristics of synchronous Ethernet equipment slave clock
ITU-T G.8264	Recommendation ITU-T G.8264/Y.1364 - Distribution of timing information through packet networks
IEEE 1588v2	IEEE standard 1588™-2008 - IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems Networked Measurement and Control Systems
ITU-T G.8273.2	Recommendation ITU-T G.8273.2/Y.1368.2 - Timing characteristics of telecom boundary clocks and telecom time slave clocks
ITU-T G.8275.1	Recommendation ITU-T G.8275.1/Y.1369.1 - Precision time protocol telecom profile for phase/time synchronization with full timing support from the network
IEEE 802.1q	IEEE Standard 802.1Q™-2014 - Bridges and Bridged Networks
ITU-T G.8265.1	Recommendation ITU-T G.8265.1/Y.1365.1- Precision time protocol telecom profile for frequency synchronization
IEEE 802.1q	IEEE Standard 802.1Q™-2014 - Bridges and Bridged Networks

For information on where to obtain these referenced documents, please see the document sources list at https://www.openreach.co.uk/cpportal/help/suppliers-information-notes-(sins)

12. Abbreviations

CP	Communications Provider
CPE	Customer Premises Equipment
DCMs	Dispersion Compensation Modules
DWDM	Dense Wavelength Division Multiplexing
ELS	Edge-Line System (Advanced Amplifier and Filter Chassis)
FGA	Fixed Gain Amp
Gbit/s	Gigabits per second
IEC	International Electrotechnical Commission
ITU-T	International Telecommunication Union- Telecommunications standardization Sector
km	Kilometre
LC	Lucent Connector
LAN	Local Area Network
MLA2	Midstage Line Amplifier
MM	MultiMode
MPO	Multi-fibre Push On
nm	nanometre
NTE	Network Terminating Equipment
NTP	Network Terminating Point
OSEA	Optical Spectrum Extended Access
PHY	Physical Layer
Rx	Receive
SC	Subscription Channel
SIN	Supplier Information Note
SM	Single Mode
Tx	Transmit

WDM	Wavelength Division Multiplexing

13. History

Issue	Date	Changes
1.0	24 March 2021	First issue
1.1	31 January 2022	Section 3.7: Correction of maximum Ethernet Frame size from 9000 to 9192. Section 9: Clarification that installation locations must meet OSEA FC Lite NTE and supporting equipment environmental requirements. Changes effective from 2 May 2022
1.1	1 July 2023	Annual Review – branding and font changes only – issue remains unchanged.
1.2	1 November 2023	Inclusion of Advanced Amplifier and Filter Chassis: Section 2.2: Additional text added. Section 3.6: New reach table added. Section 5: Re-written following introduction of Advanced Amplifier and Filter Chassis. Channel plan moved to new section 5.4. Changes effective from 27 November 2023
1.2	1 November 2024	Annual Review – branding and font changes only – issue remains unchanged.
1.3	17 June 2026	Addition of 5130 and 5169 information on • Table 2: Client Power Parameters • Table 4: Environmental

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